

## The New Face of Road Weather Information Software

### *Knowing, Interpreting, and Sharing Your Road Condition Data Will Save Lives and Money*

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#### **Introduction**

In 2006 it was estimated that the Interstate System in the United States consisted of 46,876 miles (75,440 km),<sup>1</sup> of roadway, making it the largest highway system in the world. This number only includes Federal Interstate Highways and does not take into account urban interstates, secondary, or rural roads, which most of us travel daily. With the continued expansion of highways and addition of secondary roads the total miles of roadway will only continue to increase. The use of our roadway system is the number one form of transportation; thus, it is a large responsibility and a persistent job for states, counties, and cities, to maintain, keep clear, and provide safe conditions for motorists. The primary concern for local and state agencies responsible for their roadways is the safety of the traveling public. Inclement weather has threatened transportation across the nation, and has impacted roadway safety, mobility, and productivity. There are approximately 1.5± million adverse weather-related crashes per year with 7,400 fatalities, and over 800,000 injuries.<sup>2</sup> Injuries, loss of life, and property damage caused by these weather-related crashes cost an average of \$42 billion.<sup>2</sup> Each year the average Department of Transportation (DOT) spends millions in salt and chemicals for anti-icing and snow/ice removal on pavements. Agencies are continually looking at ways to limit the use of these chemicals due to the cost as well as the adverse impact these chemicals have on the environment. Chemicals affect watersheds, air quality, and road infrastructure. While the safety of motorists is a top concern for monitoring the road conditions, the cost of traveling delays is another. The cost of congestion is said to be \$9.5 billion a year for 85 major urban areas in the United States. Weather causes account for 25% of non-recurrent delays on highways and there are an estimated 554 million vehicle-hours of delay per year from snow, ice, and fog, and other weather related conditions. Roadway weather delays have a large economic impact as it adds \$3.4 billion to freight costs annually.<sup>3</sup>

In an effort to provide safe roadways, reduce associated costs related to winter maintenance, and reduce economic monetary loss due to weather related road delays, agencies have been using Road Weather Information Systems (RWIS) for the past 35 years to gain additional information for surface transportation applications. *A Road Weather Information System (RWIS) can be explained as a combination of technologies and decision making techniques that use detailed, historical and real time road and weather information to improve the efficiency of highway maintenance operations and distribute effective real-time information to travelers.*<sup>4</sup> An RWIS station generally consists of pavement sensors that can provide pavement temperature, condition, and freeze point; atmospheric devices for

information such as wind speed/direction, precipitation rate/type, visibility relative humidity, and a camera for visual road and traffic conditions. Other optional sensors provide information on conditions such as traffic flow, barometric pressure, snow depth, sub surface temperature, and air quality. An RWIS station is typically deployed close to the roadway and it gathers the information provided by the various environmental sensors, processes it in the field then the data is collected by a Central Processing Unit (CPU). Once the data is collected it is displayed within a user's interface software where the information can be viewed and analyzed. Figure 1 illustrates the typical RWIS components.

### RWIS Station



### Central Processing Unit



### User Interface Software



Station Name	Reading Time	Status	Temp	Wd	Dir	Sp	Pr	Rel	Wind Dir	Wind Spd
Stock Road (20007)	02/02/09 15:31	DRY	110.4 °F	77 °F	68 °F	73 %	NONE	-	W	8 mph
St. John St. (20008)	02/02/09 15:48	DRY	111.2 °F	75 °F	65 °F	64 %	NONE	-	SW	-
St. John St. (20009)	02/02/09 15:49	DRY	102.6 °F	68 °F	72 °F	60 %	NONE	-	SW	7 mph
St. John St. (20010)	02/02/09 15:38	TRACE	109.8 °F	79 °F	68 °F	65 %	N/A	-	S	7 mph
St. John St. (20011)	02/02/09 15:38	DRY	108.2 °F	64 °F	69 °F	60 %	NONE	-	SW	Caln
St. John St. (20012)	02/02/09 15:33	DRY	102.4 °F	65 °F	65 °F	43 %	NONE	0 mph	SW	Caln
St. John St. (20013)	02/02/09 15:48	DRY	102.4 °F	71 °F	-	-	NONE	0 mph	E	11 mph

Figure 1

### Important Characteristics

While it is important to have RWIS stations and the correct suite of sensors deployed gathering various data, the software interface is as much, if not more, of an important factor of your system. Without effective software to display and analyze all the pavement and atmospheric data being collected from the field stations crucial and timely decisions suffer. The software interface allows transportation managers to easily obtain and understand the full picture of current weather and roadway conditions. This information assists in allowing them to efficiently manage resources, more effectively maintain their roadways, and give credible and precise travel advice. Road and weather information is used to make a number of critical decisions, such as when and where to treat the roads for snow or ice; when roads should be closed due to drifting snow; high winds; low visibility; or flooding; and if travel advisories should be posted.

The problem with many hi-tech systems today is the software can be complicated and tedious to view, which can slow acceptance of the technology or worse prevent users from adopting the technology at all.

Before purchasing an RWIS software interface the quality and usability of the software should be evaluated, as it is critical to have the right user interface to fulfill your agency's needs. Even with the best deployment and utilization of RWIS stations, problems will arise when the software interface does not present the RWIS data in an organized, easy to use, and understandable fashion. With an inefficient user interface the data collected from the various field sensors could be improperly interpreted by the user, which, in turn, will impact important decisions, or the data collected may not be usable or reliable altogether. Many people are resistant to change and if the new way is too complicated or requires a tremendous amount of effort it is easy to revert back to the previous, simpler, and more comfortable way of doing things. The best software interface designs are simple, easy to learn, and use. Having a clear and understandable interface helps prevent errors and makes important information obvious. Every visual element that appears on the screen should grab the user's attention and contribute to understanding the information presented. RWIS user interface software should provide clear and concise displays in a wide range of formats, from summary overviews to detailed site level displays. Depending on user preferences, summaries and detailed site levels should be able to be viewed in either a user-chosen map or table format. It is also important that the software menu provide easy access to all pages. In addition, embedded links throughout the page views would offer additional and easy navigation capabilities. Another important feature for RWIS software is the ability to view camera images by station, along with streaming video for those sites configured for this application. These images would give the user a good visual of current conditions as well as validate the data they have gathered. Further, the availability of historical data is valuable as it provides important information about past trends, storms, and events, which can give insight to future decisions and strategies.

A user's software interface that has a fully integrated alarming and alerting application capable of monitoring data for critical, user specified conditions may be the most valuable tool. A software interface that can send warning notifications as defined by the user allows time for deployment of snow plows, road treatment, and public advisories and notifications. These notification features help eliminate the "surprise" factor. A common feature requested by RWIS users is for the interface software to have an easy to use built-in configuration manager. Everyone has their own preferences about how things should look and feel, and they like to view data in a certain order. Giving the user the power to configure each web page and display the data that matters most will ensure the best usage of the software. Having the flexibility to configure the software, such as supplying your own map images (regional and station level), gives an agency a unique and powerful system customized to meet their needs.

### **A New Chapter in RWIS Software**

A long-time perception is that an RWIS user interface had to reside on a user-owned server. The agency would be responsible for all server administration and users either dialed-in or accessed data via the internet with a browser. This was an acceptable and fairly easy way to view RWIS data before tighter security and firewalls became highly important. However, in the past few years there has been an alternative method introduced to view RWIS data, known as a hosted server option. Now it is a question of server-based vs. the RWIS vendor owning the server and hosting the data. While there are many agencies that still prefer to own their own RWIS server and be responsible for the data collection and

administration duties, others are migrating to the RWIS vendor hosted option. With the hosted version, all the same RWIS data is gathered and can be viewed; however, it eliminates the requirement of the customer to purchase their own server. The hosted option removes the administration issues and security barriers that some agencies encounter. The data is viewed on a password protected web site and can be accessed by any computer capable of running a web browser. This makes viewing the data any time of day or night simpler and hassle free. With the hosted data option it also opens the door to data sharing among the RWIS industry. All who participate in the hosted environment have the option to share their data, and, in turn, will have viewing capabilities of the other agencies participating in the data sharing program. A hosted solution is a good alternative without losing any software capabilities or features.

### **Sharing Your Weather Data**

The idea of solely relying on your own pavement and weather condition information being enough to make critical time saving, money saving, and most importantly life saving decisions is declining. When RWIS stations were first deployed 35 years ago, they were not developed with the concept of sharing data. Data was collected from the various deployed weather stations, typically within a particular region or district, and brought back to a central server for only that district, region, or DOT to view. Not much thought was given to the value of sharing this information with others. In time, with the deployment of more RWIS stations, agencies had soon created their own “RWIS islands”. The system in place provided pavement and weather data within that agency’s parameters; however, as we all know, weather does not stop when crossing a district, region, county, city, or state line. As more RWIS stations were deployed, it became apparent that a full weather and pavement condition picture was essential to transportation managers, weather providers, and the public when making weather and road related decisions. The facts show that insufficient or poor quality road weather information can become costly in economic and human terms. In 2004 the U.S. Department of Transportation, Federal Highway Administration, in conjunction with the Intelligent Transportation Systems Joint Program Office, established what is called the *Clarus* Initiative. This research and development initiative was formed to reduce impact of adverse weather conditions for surface transportation users and provide a more accurate and complete weather picture to transportation managers and weather providers. Currently *Clarus* collects weather observations from both weather and transportation sources at a central electronic location and turns them into valuable road information available for everyone to view. Data collected include atmospheric data, pavement data, and water level data. The vision is nationwide participation of all transportation agencies. As of December 31, 2008, 33 states were connected and 10 were pending connection. The number of Environmental Sensing Stations (ESS), or RWIS, were 1,700 with 34,260 sensors providing data.<sup>5</sup> The impact and importance of data sharing is clear.

### **The Happy Ending**

With 35 years of experience in providing RWIS across North America and internationally Quixote Transportation Technologies, Inc. not only knows the importance of providing quality data collecting systems, but also realizes the importance of viewing the data on a reliable, well-designed RWIS user interface software. Navigator is the newest web-based RWIS user interface from Quixote

Transportation Technologies, Inc. (QTT). There are two product offerings for Navigator software. One is RWIS *online*<sup>™</sup> Navigator, where QTT hosts the collected RWIS data on a password protected web site. RWIS *online* Navigator offers a data sharing option, which will enable the user to view other agencies' RWIS data, including camera images, if they are also data sharing participants. The second product offering is SCAN Web<sup>®</sup> Navigator for those who prefer to collect and host data on their own server. Both product offerings have the same high level of software features, including interactive maps, which update automatically, and the ability to supply, create and configure your own regional and station level maps. Users have the capability to configure each web page to display the data that matters most, in the format they desire. The built-in configuration manager provides administrative level access to manage user accounts, application permissions, station groups, stations, and data content. Other features, such as alarming and alerting, historical data table and graphs, and PDA applications makes Navigator a powerful yet user-friendly, easy to use, and easy learn RWIS user interface solution. In addition, future plans of integrating *Clarus* and mobile weather data into this interface will make it an even more effective tool. With the industry and public need for more precise, relevant, and timely weather information it is no longer just about collecting the data, more importantly it is about how the data is presented, analyzed, and shared to assist those making critical decisions, and to help ensure the well being of our economy and the traveling public.

#### *References*

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